INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC)
PEARSON FELLOWSHIPS PROGRAM

PROACTIVE MANAGEMENT FOR ENHANCING R&D COOPERATION BETWEEN GOVERNMENT RESEARCH INSTITUTES AND THE PRIVATE SECTOR

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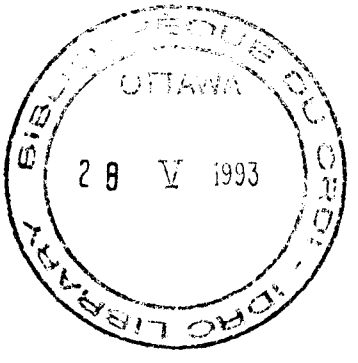
JUNE 1992



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ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to International Development Research Centre (IDRC) Head Office in Ottawa, Canada as well as the Regional Office for Southeast and East Asia in Singapore, for giving me an opportunity to participate in the 1992 Pearson Fellowships Program on Research Management. I have benefitted greatly from this year's excellent program, having been given the opportunity to spend about six months in Ottawa and the IDRC Regional Office in Singapore. Through the program I had the opportunity of meeting and discussing with many top-level Canadian and Singaporean chief-executive officers and experts responsible for the management of the Science and Technology Programs in Canada and Singapore. I also had the rare opportunity of visiting most of the premier Canadian and Singaporean R&D organization and briefed on their R&D programs. This exposure is an invaluable experience for me and will help me in my daily job when I return to my home country.

My gratitude also go to my institute, The Indonesian Institute of Sciences for the nomination and granting study leave to undertake the Pearson Fellowship Program.

My special thank go to Dr.Paz Buttedahl, as my mother during my stay in Canada who has taken care and assisted me with her warm heart. A special thank also go to Dr.Kenneth Whitham, Dr. J. A. Potworowski and Dr. Jingjai Hanchanlash for the great arrangement and assisted me to do my Research Management Project.

Dr. Eric Smith, Dr. A. Crawley, Ms. Jocelyne Caloz, Mr. Robert Sauvé, Ms. Ingrid de Alwis-Perera, Mr. J. A. Ronsyn and others from Energy, Mines and Resources Canada I would like to thank for the previous time and patiently tutor.

The last but not least I extend my thank to June Tan, Raffaella Zumpano and Aline Guay for their administrative assistance, IDRC Library for book references I needed and also all the individual who has given me their assistance during my program.

Ottawa, June 9, 1992
Sri Dewi Soenarijadi

SUMMARY

The development and prosperity achieved by many countries in the world comes from exploiting Science and Technology in order to promote the quality of the life in a peaceful and prosperous atmosphere. In the last decade Science and Technology have impacted on many sectors which increased the dependency of the Weak Science and Technology Countries on the Strong Science and Technology Countries.

Realizing the world situation, the Indonesian government through the Five Year Plan (REPELITA) is eager to improve Indonesian capability in Science and Technology . To meet this objective, two of the mechanisms is by promoting the act of R&D institutes and active cooperation between R&D Institutes and industries.

Canada as one of the strong Science and Technology country in the world have encouraged industries to play a great role in supporting science and technology trough a cooperation with Government R&D institutes in order to meet the Canadian economy challenges both national and international.

There are some mechanisms which play an important role in meeting this goal:

- o. Industrial Advisory Board;
- o. Industrial Association;
- o. Scientific and Engineering Societies;
- o. Business Office;
- o. Secondments;
- o. Contracting out;
- o. Partnership and Collaboration;
- o. Service Revenue;
- o. National Facilities;
- o. Building Confidence with industries;
- o. Exploratory R&D.

Indonesian R&D Institutes could determine the mechanisms to the Indonesian situation in order to support the Indonesian National Development Plan meet its goal.

1. BACKGROUND OF THE PROBLEM

The development and prosperity achieved by many countries in the world comes from exploiting science and technology in order to promote the quality of the life in a peaceful and prosperous atmosphere. Research activities in science are a product of human creativity and intelligence and technology is the development of science as the tool to meet human needs. Not all people in the world have the opportunity to enjoy the application of Science and Technology to gain in human prosperity. Moreover in the last decade, Science and Technology have impacted on many sectors which increase the dependency of the weak science and technology countries on the strong science and technology countries (the industrial countries). Because of innovations in technology, world competition has also been sharpened.

Realizing the world situation, the Indonesian Government through the Five Year Plan (REPELITA) is eager to improve Indonesian capability in Science and Technology by promoting an Act of R&D institutions and active cooperation/collaboration between R&D institutions and industries to acquire and develop technology in order to be an independent nation economically.

1.1 THE INDONESIAN S&T AND ECONOMIC DEVELOPMENT PLAN

The Indonesian national development plan is a part of the Indonesian nation-building. One of the ultimate goals is the development of human resource for their economic potential. It is of course understood, that to transform human resources into economic potential, capabilities must be developed for understanding the economy and industry, as must the ability to absorb and develop the driving force of them, namely Science and Technology.

To be an independent nation economically, it is clear that it must be able to produce the goods and services needed either by itself or by the world at large, in order to trade the latter for the goods and services it needs but cannot produce itself. Natural resources such as land, forest, energy, minerals etc. are a great help for the development of this capability, but they are not the main key to it. Without the capacity to acquire, possess and further develop

technology, the possession of vast reserves of natural resources is not a guarantee for the achievement of nationhood. Through Science and Technology people can develop with an economic potential and become useful to themselves as well as others. Thus Science and Technology is the key to nation building, and technology transfer and development that leads to industrial transformation are parts of the National Development Plan. To support the National Development Plan, the current research and development activities are directed as far as possible to support industries that contribute to the national development needs and economic growth. This means that research and development activities should support industries, develop technologies and improve manpower qualities. Therefore a strategy of research and development is embedded in the strategy of industrialization which focuses on the development of industries through the development of human resources in the mastering of technology. This is actually a transformation process of Indonesian human resources from an agricultural society into an industrial society.

The strategy of Indonesian science and technology encompasses the short term and long term National Development Plan namely:

1. The first phase, the use of already existing technologies for added-value processes in the assembling and manufacturing of products already on the domestic as well as the international market. In this phase, manufacturing and management technologies are used to transform raw material and intermediate products into higher-value finished products. In doing this, industries could of course utilize the technologies which are available in the country, but if they are not available, the shortcut is to import technologies from abroad and produce the existing products under license.

2. The second phase, integration of existing technologies within the framework of producing new goods. In this phase, technologies are used and developed to create blueprints and designs, thus adding the element of creativity to the first phase. In addition to design capability, other skills such as skill in integration and optimization of components into new systems are gained.

3. The third phase, the stage of development and improvement of technology. In this phase the existing technologies are improved and new ones developed in the effort to design and manufacture the products of the future. This phase encompasses innovations and creation of technologies for components to be integrated into products which will be the most advanced in their respective markets.

4. The fourth phase, the development of science and technology through basic research.

Based on Indonesia's size and composition and the need to strengthen its political integrity and to develop a unified national economy, the whole transportation and communication sectors are the logical technology transformation vehicles.

They are as follows:

- the aircraft industry;
- the shipbuilding and maritime industries;
- the land transportation industries;
- telecommunications and electronics industries;
- the energy industries;
- the engineering industries;
- the agricultural equipment and machinery industries;
- the defense industry;
- the software industries.

In accordance with the technology transformation vehicles, then the fields of research and development should cover : food technology, housing technology, clothing technology, health science and technology, aero and space science and technology, ship and maritime technology, land transportation technology, telecommunication and electronic technology, energy technology, engineering science and technology, agriculture machinery technology and defence science and technology.

And in supporting research activities, the government gives the direction for the development of science and technology program, as follows:

a. Research and study on the basic needs of man;
b. Research and study on Natural resources and energy;
c. Research and study on industry;
d. Research and study on the field of socio-culture, economy philosophy, law and legislation.

To realize the programs, the Government promoted the act of R&D institutions and its collaboration with industries to acquire and develop technology.

There are four types of research and development institute in Indonesia:

a. Non-departmental R&D institutes which are under the coordination and control of the Minister of State of Research and Technology;

b. Departmental R&D institutes which are under the control of their related ministry;

c. Universities which under the guidance of the Ministry of Education and Culture;

d. R&D sections of private sector companies.

The R&D institutes which are under the coordination and control of the Minister of State of Research and Technology are: (1) The Agency for the Assessment and Application of Technology (BPPT), (2) The Indonesian Institute of Sciences (LIPI), (3) The National Atomic Energy Agency (BATAN), (4) The Indonesian National Institute of Aeronautics and Space (LAPAN), (5) The Coordinating Agency for Surveys and Mapping (BAKOSURTANAL) and (6) The Centre Bureau of Statistics (BPS).

In developing research and technology, one of several problems encountered is manpower development. The main bottleneck to the development of Science and Technology in Developing Countries is the lack of managerial capability at both macro and micro levels. So the need to

educate and train human resources in the management of Science and Technology was given priority. The education and training program is carried out using Government funding as well as foreign aid.

In order to meet the goal in developing science and technology as one of the economic development tools, the Government raised the percentage of the Science, Technology and Research budget year to year as shown in figure below:

Table. 1. Budget Percentage of S&T in Proportion to GNP

Year	Budget (US$ 000s)		GNP	Budget Percentage	
	R&D	S&T		R&D/GNP	S&T/GNP
88/89	64,082	235,983	66,357,250	0.096	0.36
89/90	63,621	286,810	66,700,000	0.095	0.43
90/91	88,031	389,677	70,026,000	0.126	0.55

Source : LIPI, 1991

1.2. INDONESIAN INSTITUTE OF SCIENCES (LIPI) S&T MISSION

Indonesian Institute of Sciences (LIPI), one of the Government Institutes which deals with research and development,was established in 1967. The Indonesian Institute of Sciences is directed by a Chairman and a Vice Chairman, assisted by five Deputies (the Deputy for Social Science and Humanities, the Deputy for Natural Sciences, the Deputy for Engineering Sciences, the Deputy for Development of Scientific Infrastructure and the Deputy for General Affairs). Each Deputy is responsible for coordinating R&D centres, bureaus or technical implementation units (Appendix 1). In 1986 the main tasks, function and organizational structure of LIPI was reviewed and adjusted in line with the S&T development plan and the role of LIPI in national development. LIPI underwent a reorganization in which its operational units constitute strategic elements which should have the abilities to face future challenges. The tasks of LIPI as reconfirmed in the Presidential Decree No.1, 1986 involve:

1. Research and Development in S&T;
2. Promotion of the development of S&T;
3. Provision of Scientific and technological services;
4. Recommendations to the Government on the national S&T policy.

Research activities of LIPI have been organized according to the grouping of the Research and Development Centres as coordinated by their respective Deputies. In trying to promote the development of Science and Technology in Indonesia, various strategies have been developed as follows:

- o manpower development: to increase the competitive ability and hence to improve the research capability of research workers;

- o the state of the art of S&T: the development of science and technology nationally has been monitored through convening of a National Science Congress (KIPNAS) every five years;

- o Professional Societies: LIPI has provided means for the existing professional societies to have a common platform in exchanging information and sharing experience as well as ideas in developing science through cooperative efforts by members of these societies;

- o the popularization of S&T: programs for the popularization and dissemination of S&T consist of the publication of R&D results to the whole community through all available systems of information services, through scientific publications, daily newspapers, journal, radio and television;

- o National and International S&T cooperation: LIPI has developed cooperative relationship with several national and international institutes and organizations.

In scientific and technological services, LIPI provides services on standardization by disseminating information on standardization through the Centre for Standardization-LIPI. LIPI also provides calibration, instrumentation and metrology services for government institutes and private enterprises, especially to support industry in producing products of quality which can compete in the international market. To support R&D activities, the Centre for Scientific Documentation and Information-LIPI provides library, information, consultation and referral services and publications. And to

promote cooperation between Indonesian and foreign researchers, LIPI acts as the scientific authority to issue permits to those who intend to carry out research in Indonesia, after considering the scientific and security factors involved.

And since the first national Five Year Development Plan, LIPI has made an inventory and assessment of science and technology resources to be able to provide an overall picture of the condition, capability and trend of science and technology development. The results have been used by the Government in formulating science and technology policy. For example, policies adopted by Government based on scientific data and information provided by LIPI include food and nutrition policy, criteria for the designation of nature reserves, skilled technical manpower development, germplasma conservation and so on.

And in accordance with the mandate entrusted by Government, the functions of LIPI are:

a. To conduct mission oriented R&D in S&T;

b. To provide data and information for national policy on S&T for development;

c. To promote the development of S&T;

d. To promote the public awareness of the role of S&T in development;

e. To promote the capabilities of the Indonesian Scientific Community;

f. To promote and strengthen cooperation in S&T;

g. To promote services in S&T.

LIPI currently employs about 4800 persons:

Table 2 : MANPOWER OF THE INDONESIAN INSTITUTE OF SCIENCES BASED ON EDUCATION IN 1989

Education	Dep.SSH	Dep.NS	Dep.TS	Dep.DSI	Dep.GA	Total
Doctor	12	27	20	3	3	65
Master	22	25	35	24	5	111
University Graduate	128	388	266	164	99	1035
Bachelor	15	73	116	88	53	355
SHS Graduate	100	723	660	305	227	2015
JHS Graduate	14	191	99	33	19	356
Primary school	17	524	107	47	47	742
Total	308	1951	1303	664	453	4679

Source : LIPI

As one of government institutes dealing with R&D, LIPI is supposed to produce academic results. In accordance with National Development goals, LIPI is also supposed to produce R&D results which support the National Development process. Thus the research programs of LIPI are strategic and mission oriented, inter-disciplinary, and support various development sectors. Therefore LIPI would like to explore the possibility of better cooperation in R&D with other government institutions as well as private sectors/industries.

The cooperation programs/S&T services conducted by the Indonesian Institute of Sciences meet the requirement of the partnership / the users or the government. These programs can be divided into:

1. Cooperation programs/S&T services such as research and development studies, installation engineering, tests of quality, calibration and metrology, and training/scientific meetings.

2. Direct cooperation/S&T services given directly to the partners/clients, such as material, information, library services etc.

At the present time, LIPI cooperates with other government institutions, universities and the private sector. The cooperation programs between LIPI and other government institutions are generally in order to promote science and technology which interrelate with the national program in S&T. The cooperation programs with the Local Government deal with the promotion of the capability of the Local Government in S&T, which support the national development. The programs with the private sector usually take the form of grants for young scientists to do research or a case study.

The source of funds for the cooperation activities come from the national development budget. At least 6 months before the fiscal year starts (1 April) the R&D Centres have to propose a budget to the Chairman of LIPI through their respective Deputy. For example, the R&D Centre for Biology submits their financial plan to the Deputy for Natural Sciences. And then the Financial Committee examines the proposal before its submission to the Financial Department for approval.

The financial report on the programs should be submitted every month to the Chairman of LIPI and the technical report should be reported quarterly. The head of the program will submit a progress report to the Chairman of LIPI at the end of the program. The quarterly reports act as a monitoring tool. If a problem is faced during the activities, the head of the program would come to the respective Deputy and discuss the problem to reach a resolution.

So far LIPI does not have much cooperation with industry. Almost all the cooperation activities of LIPI are in collaboration with other government institutions, Local Government,and universities.

In view of the government priority to promote cooperation between Government R&D institutions and industries so as to acquire and develop technology in order to be an independent nation economically, it is a challenge for LIPI to explore more opportunities for cooperation with industries. To meet the challenge LIPI has to promote its capability in marketing strategies, in understanding the needs of industries, in knowing how to reach clients, how to communicate with clients, etc.

At this time, large companies prefer to buy or license technology from outside the country, and small companies do not yet believe that R&D activities can relate to their business prosperity. The problem is how to influence them to cooperate with LIPI in R&D programs in order to participate in National Development through development of national technologies and improvements in manpower quality.

2. MECHANISMS FOR ENHANCING R&D COOPERATION: CANADIAN EXPERIENCES

As Canada enters the 1990s, it faces serious national and international challenges that will determine its economic well being, as well as the quality of life for its citizens. And in this rapidly changing world, global competition in resources, goods, and services is intensifying, putting pressure on Canada to develop and implement national strategies, especially in science and technology that will adopt to these challenges. Science and technology will be regarded as the critical factors driving the process, especially in assisting traditional industries to increase their R&D investments and in accelerating their adoption of new technologies from elsewhere. Consequently, a high priority will be given to forging a consensus between government and industry in resolving resource allocation issues and in supporting necessary actions through partnership.

In 1987 Canada launched INNOVACTION as a Canadian strategy for Science and Technology. Innovaction identifies the Canadian Government's key priorities for Science and Technology and provides funding for initiatives that meet the Canadian challenges. There are five S&T strategy areas in Innovaction:

1. Increasing industrial innovation and technology transfer;
2. Developing and promoting strategic technologies;
3. Managing Federal science and technology resources more effectively;
4. Ensuring the supply and development of human resources required for S&T;
5. Promoting public education in science and technology and a more science-oriented culture.

And in developing Innovaction, the Canadian Government was guided by four basic principles, as follows:

1. Industry must play a greater role in supporting science and technology. Government must stimulate private sector investment and create a positive environment for innovation and entrepreneurship;
2. Cooperation among all science and technology players. Industry, labour, university, colleges and government must work together to ensure the best return on Canada's science and technology investment;
3. While the government must pursue certain R&D activities for the public interest, in such areas as national security, environment protection and the promotion of health safety, social and cultural goods, there is significant unrealized potential for the commercialization of government technology which must exploited;
4. Canadian industry must strengthen efforts to import state of the art foreign technology that serves Canadian needs. Canada cannot remain competitive unless it acquires world class technologies wherever they are available. The private sector and universities should be encouraged to undertake joint efforts with foreign partners.

To support the realization of Innovaction, Canadian R&D institutes increasingly focused their programs on the directions of Innovaction, particularly on enhancing the cooperation with industries in R&D programs in order to promote competitiveness of the Canadian industries in the world market. They have also worked to improve the manpower capability, and to meet the Canadian needs in exploiting their resources and have still paid attention to health, safety and environment control. To create and enhance the cooperation between Government R&D institutes and the private sector/industries there are some key mechanisms which play an important role in meeting this goal.

2.1. INDUSTRIAL ADVISORY COMMITTEES

In most Canadian Government R&D Institutes there are industrial advisory committees which provide the institutes with policy direction and advice for their plans and activities. The members of the committee come from senior representatives of industry and the universities. The recommendations of the committee are fundamental to the decision making process. For example, in CANMET (The Canada Centre for Mineral and Energy Technology) there is the Minister's National Advisory Council to CANMET (MNACC). The purpose of MNACC is to advise the Minister of Energy, Mining and Resources on:

- mining, metallurgical and fuel research in Canada and abroad;
- programs and research work of CANMET;
- managerial performance of CANMET;
- coordination of Federal Research Programs with others;
- R&D policy and trends.

The membership of MNACC consist of a chairperson, six chairpersons of subcommittees (senior industry management), members-at-large (up to 6 industry members, 2 university members, 2 Provincial Representative Organizations), Government ADM (CANMET) and AD HOC members including any representatives of associations that Minister may wish to appoint.

The Main Committee functions are:

- Approval of strategic plans and direction;
- Recommend research emphasis and priorities;
- Review and accept Subcommittee reports;
- Determine cost recovery levels and policies;
- Consult with Minister;
- Recommend Council succession to Minister;
- Appoint task forces and AD HOC Groups;
- Recommend Subcommittee chairpersons and membership for appointment by Minister.

There are six Subcommittees under the Main Committee, namely: Mining Subcommittee, Coal Mining and Preparation Subcommittee, Mineral Sciences Subcommittee, Energy Research Subcommittee, Metals and Material Subcommittee and Business Subcommittee (Appendix 2).

The functions and operations of the Five Program Subcommittees are:

- o Review and critique research program;
- o Guide medium and long term plans;
- o Influence operational plan for forthcoming year;
- o Form special AD HOC task forces;
- o Prepare an annual report for submission to the Main Committee;
- o Visit laboratories and involve Directors, Managers, Scientists and Engineers.

And the functions and operations of the Business Subcommittee are:

- o Review Business Plans: operational review, market strategy, and resource plan;
- o Prepare report to Main Committee and Minister;

Both the Main Committee and the Subcommittee meet twice a year.

The composition, type, number of members, etc of the Industrial Advisory Boards are adjusted to the mission, tasks and needs of the institutes. For example there are Advisory Boards to each of the Research Institutes of the National Research Council (NRC). NRC has used a variety of external advisory groups and associate committees to support the planning and assessment of its research activities.The members come from industry society and the universities. Advisory Boards for each NRC institute or major program are composed of scientists, engineers and business leaders from across and outside Canada. These Boards provide a systematic approach for involving NRC's stakeholders in planning and managing its activities. This development responds to past concerns about feedback and involvement of partners and clients in government programs and also provides for increased accountability (Appendix 3).

One important thing about such Committees is that the membership tenure should be defined so as to allow new members to contribute new ideas in giving advice to the institutes. If there is no regeneration in the committees, the committees stagnate. So the length of the membership should be clearly stated and not for too long a period.

Secondly to be effective the committees must either report to or have access to the senior level of the organization (e.g. President of the NRC, or with the Vice President of the sector to which the institute is assigned, in the case of NRC and the

Minister of the Department in the case of EMR as well as senior officials). This way their advice can be effective and senior people can be persuaded to serve on the committees at no cost as a form of public service.

2.2. INDUSTRIAL ASSOCIATIONS

Industrial Associations such as the Canadian Electrical Association (CEA), Canada Gas Association (CGA), Pulp and Paper Research Institute of Canada (PAPRICAN) etc, have an important role to play in enhancing the cooperation between Government R&D institutes and the industries. The industrial Association mission is to promote a positive approach to change, enhancing efficiency and achieving a better understanding of the industries role, to support their members in meeting their challenges, etc. The Industrial Association also has a role as liaison between the industries and Federal Government Agencies and Departments.

Through the industrial Associations, the Government and its institutions can get information about the industry's needs,goals and achievements. The information can be obtained through scientific meetings (workshops, seminars, etc), newspapers, bulletins and reports published by the Associations.

Some of the Industrial Associations have their own R&D laboratories so they can undertake their research activities: for example, PAPRICAN (The Pulp and Paper Research Institute of Canada) maintains laboratories in Pointe Claire, Quebec and Vancouver, British Columbia. Both laboratories were constructed with the financial assistance of the Government of Canada. Facilities are also made available to the institute in the Pulp and Paper Research Centre at McGill University. The Pulp and Paper Centre at the University of British Columbia and on the campus of Ecole Polytechnique. The total staff at all locations consists of approximately 375 scientists, engineers and supporting personnel. The operating costs for the institute's research and education programs are borne largely by the Institute's Maintaining Member Companies, who represent nearly all of the pulp and paper producers in Canada. Some financial assistance is provided for a number of research projects by Allied Industry and the Federal Government. The Institute's research program responds primarily to the long-term research needs of its supporting companies in the Canadian pulp and paper industry. This is achieved through a strategic plan which is developed and maintained current by the Institute management with its Research

Program Committee (RPC) made up of industry representatives. The process includes consultation with the members through liaison representatives to each company, (a PAPRICAN liaison representative is assigned to visit each mill) and the institute's staff. The RPC, which reports to the Board of Directors, is responsible for reviewing the Institute's performance annually to ensure that PAPRICAN is meeting the industry's needs. PAPRICAN was established in 1925 and had a total expenditure of about C$ 30 million in 1990.

Some Industrial Associations which do not have R&D laboratories, contract out projects to the Canadian Scientific Community, private consultants, R&D centres, manufacturers, and university research programs. For example, the Canadian Electrical Association was established in 1891 and its R&D program created in 1974. The CEA R&D program is jointly funded by members utilities (almost 40 major Canadian electrical manufacturers and several hundred other company and individual members). In 1990 CEA has 69 ongoing projects contracted out have a value C$ 13,000,000.

The links between the government R&D Institutes and the industrial association must be close at the technical level. And R&D activities of these associations are often important potential partnership for the partnership of government institutes.

2.3. SCIENTIST AND ENGINEER ASSOCIATIONS

The technical staff of the Government R&D Institutes are active in all the activities of the Scientific and Engineering professional Societies across Canada. In this way they get access to new ideas and trends, and in presenting their own work at meetings, workshops, seminars, etc. get valuable feedback on their activity from industrial, academic and other government institute members.

This allows for the free exchange of ideas at the working level, and provide valuable input to the future work of the Institutes. Its also make the work of the Institutes better known and gives opportunities for the scientists and engineers, especially the youngest ones to improve their knowledge through attending such meetings.

2.4. BUSINESS OFFICES

In most major Canadian R&D Institutes there is a business office with its mission is to develop, foster and promote mechanism to facilitate technology transfer. The business office acts as a "gatekeeper" between the R&D Institute and the industries. This office is responsible for developing communication strategies to clients in order to support the institute's objectives and for coordinating the preparation of all publications, annual reports, technical reports, newsletters, Business Opportunity Documents etc. and disseminating them to clients. Beside the above tasks, the Business Office can also assist the institute in organizing conferences, seminars, workshops and other special events. This office thus provides technology transfer services for the institutes and clients.

Clients will come to this office to get information about the institute such as laboratory facilities, opportunities to cooperate, the Institute's programs etc. They need such information in order to make sure that the institute can meet their needs.

As the "gatekeeper" of the R&D Institute the Business Office has to develop appropriate information materials. For example, there is Marketing and Information Services in NRC and a Technology Marketing Division in CANMET. The Technology Marketing Division (TMD) in CANMET has the function to:

- o develop high-quality communications products and implementing strategies to raise the level of awareness of CANMET through publications, press release, promotional material, conferences and seminars;
- o develop policies, procedures and guidelines on the management of CANMET's intellectual property;
- o develop standards for negotiating R&D and licensing agreements with CANMET clients;
- o gather and record information on the mineral and energy industries, and on CANMET-client relations as they pertain to technology transfer activities;
- o assist clients in accessing technologies in Canada and elsewhere.

The Technology Marketing Division (TMD) has five sections, namely Intellectual Property Management Section, Marketing Section, Industry Relations Section, Editing Section, and Graphics Section. The primary client groups of TMD are CANMET's operating divisions and their industrial partners and corporate clients

(including Central Government Agencies such as Industry, Science and Technology Canada and Treasury Board). TMD also provides advice on patenting and licensing, negotiation and preparation of agreements. In this case TMD works with patent agents to assess the patentability of CANMET inventions.

For the Business Office to meet its tasks effectively, personnel have to actively communicate with the clients. Therefore staff from the Business Office have to visit the clients regularly to introduce the new R&D products, ask the clients about problems and offer cooperative programs to solve the problems, disseminate Business Opportunity Document, etc. Very clearly the proactive activity of a Business Office is a most important mechanism to increase cooperation between Government R&D institutes and the private sector.

2.5. SECONDMENTS

Secondments occur when staff is exchanged between the Government R&D Institutes and the industries. The objective of such a program is to exchange ideas and experience between the Government R&D Institutes and the industries, and promote the transfer of technology. This program also has made an important contribution to the development of scientists, engineers and technical support personnel. The length of such a program can vary: it could be for weeks, months or a year or longer.

The benefit of this program for the industries is that their employees can increase their knowledge and capabilities by using the specialized the R&D laboratory facilities of the government in a direct work experience. In the other side, the R&D Institutes can introduce their facilities, capabilities, programs and staff to the industries. In the secondment out program, the R&D Institutes can learn directly the problems of the industries and thereby increase the possibility of cooperation to solve these problems or needs. They can also use this mechanism to transfer a technology to a client very efficiently and effectively.

The Government R&D Institutes have promoted this program year to year. In 1989-1990 almost 200 Research Associates participated in this program of NRC. CANMET's data shows that it also has promoted this program.

Fiscal year		Secondments PYs In	Secondments PYs Out
Actuals:	1988/89	8	4
	1989/90	11	8
	1990/91	17	11
Targets:	1991/92	19	15
	1992/93	19	16
	1993/94	22	18

Source: CANMET, Business Plan 1992-1995

2.6. CONTRACTING OUT

In some cases R&D Institutes have funds at their disposal for contracting out R&D programs to the industries. The purpose of this program is stimulate the industries so as to promote their capabilities and to increase the cooperation between the R&D Institutes and the industries. Sometimes the industries do not have the funds to undertake the research and need government assistance and sometimes they can do R&D to meet a government need. With the government funding they can participate in developing advanced technology in order to develop stronger economies by achieving higher quality and performance in their tradeable goods and services. So it is clear that Canadian industries needs government support to develop national competitiveness.

To support this program, CANMET in 1992/1993 provided a budget about C$ 24.7 million. The program can also attract the dollar support of other institution in some cases, thereby helping all participants. Most importantly the program can be use to lever a partial or full cost sharing with industry, thereby achieving the aims of the institute in levering more R&D and also building up stronger links and understanding between an R&D institute and a private sector entity.

This program has been particularly successful in the remote sensing sector in Canada: industry and government have worked closely together to achieve a world class industry based on many products produced by Canadian Centre for Remote Sensing (CCRS) contracting out all R&D program selectively to carefully chosen and focused companies.

2.7. PARTNERSHIPS AND COLLABORATION

A major mechanism of Canadian R&D Institutes for increased cooperation with industry is the development of partnership and collaboration as the most effective way to ensure relevance and to efficiently apply its resources and capabilities to serve Canadian's needs. The partnership and collaboration in R&D program between R&D Institutes and the industries is perhaps the best means of achieving the country's goal. The R&D activity is jointly planned and conducted by the partners according to their means: no money is exchanged between the Government Institute and the industrial partners.

The partnership and collaboration programs are strategic often with international commercialization potential in which the R&D Institutes share the risk with industrial partners. This program can stimulate a number of significant new initiatives in R&D involving sometimes other partners in both the private or public sectors.

In a partnership, intellectual property rights need consideration. Each of the parties usually has equal rights in the results and could use the results for commercialization. In order to protect the public servants, especially if there is an invention, there is a Government regulation that under the public servants inventions act, all inventions developed by public servants in the line of duty or employment or with facilities, equipment or financial aid provided by or on behalf of the government belong to the Crown. Even if the invention was made jointly with another person who is not a public servant, the interest of the public servant vests in the Crown.

The purpose of the regulation is to ensure that the exploitation of intellectual property's for the benefit of Canada. If there is no invention, the industries can use the results for commercialization purposes, but in general it is requested that intellectual property might should be discussed at the beginning and stated in the partnership agreement. Generally nowadays intellectual property rights in partnership can be mutually agreed with no major difficulties prior to the start of the work.

2.8. SERVICE REVENUE

Another important mechanism in enhancing the cooperation between Government R&D Institutes with the industries is through service revenue. The objective of this technique is to have the institute solve problem through in-house work that cannot be solved by the industries. Such a program is carried out by a signed-off an agreement between the R&D institute and the industry. Before signing the agreement, the two parties discuss in detail the type of the agreement and the cost estimate.

There are two types of service revenue/cost revenue programs, namely:

- o Cost recovery project is a project in which the client pays 100% of the cost of services/goods provided by the R&D Institutes.
- o Cost shared project, is a project in which the cost is shared between R&D Institute and the client.

In the cost recovery and cost shared project, the client expects to receive periodic progress reports and a final report at the end of the project. The reports are usually referred to as deliverables. The client has free use of the information contained in the deliverables. Since the intellectual property used on any belong to the Crown, care must be taken to ensure that the deliverables do not contain any propriety information not covered in the agreement. It is important that all parties involved in the project understand the anticipated content of all deliverables before an agreement is signed.

Before coming to an agreement on cost recovery/cost shared or the other type of agreement it is important to make a study of the clients characteristic as CANMET has done (Appendix 4). The purpose of the study is to get clear information, on the nature and size of the company.

It is important that a government R&D institute engaged in cost-recovery activities for the private sector do this in such a way that it not be accused of unfair competition by another private sector company which feels it can market such a service.

2.9. NATIONAL FACILITIES

The national science and engineering infrastructure is also a critical factor in national competitiveness. These facilities have an important role in supporting the development of innovation and helping companies to upgrade their products and capabilities. Canadian R&D Institutes have tried to promote their infrastructure facilities as well as the capabilities of their people to meet clients' needs.

The National Research Council (NRC) has numerous facilities which are available to help back up Canadian companies. Access to NRC's specialized equipment and major engineering facilities and resources that most companies cannot afford, can provide Canadian companies the edge in developing their own technologies. Some of the NRC's major facilities are:

- o standards laboratories to ensure precise measurements and uniformity to meet international market requirements;
- o a variety of test aircraft and simulators for aerospace industry;
- o major testing facilities for railways and other ground transportation industries;
- o pilot-scale biotechnology fermenters;
- o seven wind tunnels for testing buildings, bridges, air-craft and other vehicles.

As a strategic priority during the next four years, NRC will promote and enhance the use of its facilities as national resources in support of Canadian competitiveness through partnerships and collaborations and also as a means of practical training. These facilities are both expected to increase their revenue and augment their capabilities, thereby contributing to both the long range plan objective of increased leverage and to more effectively serving the competitive ability of NRC's clients. And through the NRC Industrial Research Assistance Program (IRAP) and the Canada Institute for Scientific and Technical Information (CISTI), NRC has extensive and flexible means for meeting the technical needs of Canadian industry.

Through IRAP, NRC helps Canadian companies find appropriate technology from a wide range of domestic and international sources. As the only national technology transfer network in the country, IRAP helps Canadian firm develop world class technology that they cannot afford in their own, because IRAP accesses more than 200 technology advisors across the country, including technology transfer specialists in major R&D facilities.

NRC, Canada's Institute for Scientific and Technical Information (CISTI) is the second largest provider of science and technology information in North America. It responds to half a million requests for information each year. CISTI staff have access to hundreds of national and international data bases as well as its own collection of more than 50,000 journals, half a million books and two million technical reports on microform. Its services also include customized literature searches, development of highly specialized database systems, and referral to experts to answer complex scientific questions.

2.10 BUILDING CONFIDENCE WITH THE INDUSTRIES

Another mechanism in enhancing the cooperation between government R&D institutes and industries is through projects which help the industries in promoting the quality of their product and meet international standards, thereby improving their competitiveness in world markets. Because one of industries's needs is to reach high quality, low cost and competitiveness in the market place, the need can be met by designers, engineers and workers who have special skills in these points. One of the Canadian R&D institutes which has the capability to meet the industries's needs is ORTECH International.

ORTECH International was founded in 1928 and now has 390 employees with a facility of 28,000 square metres of space in three locations in Mississauga (headquarters), Thorold (Niagara Centre) and Clearwater (Southwestern Ontario Centre). It has 2,500 industrial clients which come from manufacturing, transportation/communication, service, construction, mining and governments.

ORTECH International is a broadly based technical services enterprise, dedicated to satisfying the needs of private and public sector organizations. ORTECH provides the highest quality services in product and process design and development, problem solving, analysis, testing and evaluation with emphasis on environmental, materials and transportation technologies.

ORTECH has the size and flexibility to work effectively with clients of all sizes. Large companies use ORTECH for specialized expertise or as an alternative to corporate R&D initiatives, and the small and medium size companies come to ORTECH because of a lack in R&D facilities or a need to extend their existing capacity without incurring the increasingly onerous capital costs. Institutes such as ORTECH have specialist performance standards measurement facilities which can help industry greatly in improving consumer acceptance of its products and in

meeting and improving international competitive standards, thereby increasing both the domestic and foreign markets of its products. CANMET has performed a similar role for its clients, e.g. with its coke oven facilities for the Canadian coal industry in the Japanese market.

2.11 EXPLORATORY R&D

The last one of the mechanisms to enhance the cooperation with industries is exploratory R&D. The purpose of exploratory R&D is to conduct high risk, long term R&D in advance of industrial need and therefore neither supported nor sponsored by an outside client. The budget for this kind of activity is generally only a small proportion of the total budget of the institute.

If the Industrial Advisory Committees are made aware of these activities and the basis for the choice of projects, such work helps keep industries aware of the long-term technology trends and may in certain cases encourage greater industrial risk taking. Such R&D work can also stimulate industry to move into areas of government policy priorities earlier than otherwise they might.

3. RELATION OF THE GOVERNMENT - INDUSTRY LINKAGE MECHANISMS TO THE INDONESIAN SITUATION

As directed by the policy, the focus of the Indonesian R&D programs is linked directly or indirectly to the strategy of industrialization. Therefore the strategy of research and development is embedded in the strategy of industrialization which focuses on the development of human resources in mastering technology and the development of technology. To support the industrialization strategy, research activities should be directed to finding better manufacturing technologies and processes for the industries which use older technologies so as to add value for the manufacturing of products already on the domestic as well as the international market. The research activities are also expected to generate better design and new technologies for future products so as to support competitiveness in the global market.

To support the Government's tasks and meet its objective, the R&D institutes have to have cooperation with the industries. In this matter, the R&D institutes have to study the mechanisms which might enhance the relationship between the two parties.

Canada as one of the industrial countries has a great deal of experience in cooperation programs between R&D Institutes and industries in order to develop technologies for the economic benefit of Canada. The Indonesian R&D institutes could study some of the Canadian mechanisms which might be applied to the Indonesian situation. It should be understood that the Indonesia situation as a developing country is quite different from Canada which is one of the group of seven industrial countries in the world. Nevertheless, the Canadian experience could suggest some points for the Indonesian R&D institutes in improving their management of science and technology.

3.1 INDUSTRIAL ADVISORY BOARDS

In Indonesia, not all R&D institutes have an Industrial Advisory Board to provide the R&D institutes with a future direction on their programs, review the technical programs annually and advise them on resource allocation. In R&D institutes like LIPI, there is an Advisory Board which is called "Dewan Pembina Ilmu Pengetahuan Indonesia". The members of the Board come from government and universities. The function of the Board is to advise LIPI and provide direction for its programs. However, the Advisory Board has not functioned as expected, is not active, and does not meet regularly, so there is no external advice or input for the R&D Institute which could assist in decision making. R&D institutes oriented more to applied science like the Agency for Assessment and Application of Technology (BPP Technology), usually have an Advisory Board whose members come from the appropriate client industries. But the BPP Technology also has the same problem that its Advisory Board is not as active as expected. In this case, the Minister of State for Science and Technology, who is also the Chairman of the Institute, take over the Advisory Board's responsibility in giving program direction to the institute. Hopefully, in the future the Advisory Boards could become more active as originally expected, because their role is important to the R&D institutes to improve their linkages with client organizations.

3.2 INDUSTRIAL ASSOCIATION

Some industrial associations are established in Indonesia, but they do not have laboratories. In Indonesia, industry is divided into multinational industries and local industries. The R&D laboratories of the multinational industries are located in the countries where their technology comes from. For example, Coca Cola, Ajinomoto, etc. Indonesia licences technology from them to establish local manufacturers. On

the other hand, the local industries do not believe it is important to establish an R&D laboratory, because of the cost and the long time frame required to obtain a return on the R&D investment. So they prefer to buy technology rather than develop it themselves. It remains a challenge for the R&D institutes to influence and offer them cooperation in relevant R&D programs where they could benefit without establishing their own laboratories.

3.3 PROFESSIONAL SOCIETIES

The Indonesian Institute of Sciences has provided means for the existing professional societies (Scientist and Engineers Association) to have a common platform in changing information and sharing experience as well as ideas in developing science and technology through cooperative efforts by members of these associations. But right now this kind of association in Indonesia is not as developed as might be wished. The reason is the limitation on budgets and the need for government support for professional associations or societies. The Government has tried to support them with some funds but they have still not developed. Factually, it takes a long time and perseverance to develop a scientist community.

3.4 BUSINESS OFFICE

The Business Office of R&D institutes are usually not proactive and prefer to wait until the clients come to their office rather than visit their clients. And because of budget constraints they also do not have good facilities yet, cannot produce enough brochures, reports, etc. and disseminate them to the clients. Recently the Government has tried to increase the budget for this particular need, so in the near future such offices should meet their tasks better. But for success it is important that the institutes change their work habits and improve their manpower capabilities, because usually the R&D institutes give priority to improving the knowledge of the scientists who work in laboratories. It is important to improve the knowledge and capability of the supporting staffs in order to support and give better service to the laboratory people. This includes the staff of the Business Offices.

3.5 SECONDMENTS

A secondments program is a good program to promote the technology transfer to the industries and strengthen the relationship between the R&D institutes and industries. The problem in applying such a concept in Indonesia is how to influence the industries to accept this program rather than just buying technology, and persuade them that through such a program their employees could improve their knowledge and capabilities with benefit to their daily job performance. The other problem which might be faced arises from the big gap in salary between government officials and an industrial employee in the same position. Sometimes the R&D institutes worry that the industries would influence their scientists on secondment because the industries can offer them a better salary.

Before offering this program to industries, the R&D institutes have to be confident that their laboratory facilities could meet the industries' needs and make the industries satisfied by cooperation through such a program. The government has to pay attention and support the R&D institutes to promote their infrastructure facilities in order to meet the industries' needs and remain up to date.

3.6 CONTRACTING OUT, COST SHARED, AND COST RECOVERY R&D

Considering the R&D institutes' budget at this time, it is impossible to contract out a significant part of their programs to the industries. Furthermore, the industries do not have the laboratories or capability to accept contracts. At this time, the R&D institutes expect that the industries preferably contract with them, so the feasible type of cooperation between the R&D institutes and the industries involves cost recovery, cost shared R&D, licensing or partnership.

3.7 BUILDING CONFIDENCE WITH THE INDUSTRIES

Some R&D institutes provide scientific and technological services although in a small way in comparison with the Canadian institutes such as ORTECH International. For example, the Indonesian Institute of Sciences provides services on standardization by disseminating information on standardization through the Centre for standardization-LIPI which provide a national information network on standardization. It provides library, information, consultation, reference services and publications on standards. In addition, LIPI is the Secretariat of the National Standardization Council which coordinates, synchronizes and promotes cooperation

between institutes related to standardization activities in Indonesia. LIPI also provides the calibration, instrumentation and metrology services for government institutes and private enterprises, especially to support industries in producing products of quality which can compete in the international market. The other services that are provided by LIPI are library services. Hopefully with a better budget, more and capable manpower in the future, the Indonesian R&D Institutes could promote their services to the industries in this respect.

3.8 EXPLORATORY R&D

The Indonesian Government still pays attention to promoting the knowledge of its scientists through exploratory research activities. To meet the goal of the National Development Plan and to become an independent nation economically, it is essential to master technology. Exploratory research includes the basic research for a country like Indonesia which must improve its the knowledge in order to master technology. Without mastering the basic science, a nation would be remain a technology buyer. Realizing its importance, the Government provides the R&D budget for this work although the government program concentrates on the strategic research, which could support the industrialization of the country.

4. RECOMMENDATIONS

In accordance with the national development plan, LIPI as one of the government institutes which deals with R&D, is expected to produce R&D results which could support the National Development process which focused on industrialization. Therefore, LIPI expects to improve cooperation with the private sectors beside cooperation with other government institutions and universities. To meet its challenge, LIPI has to be proactive in its search for clients and innovative ways to meet their needs. To support its effort, LIPI has to improve the knowledge and capability of its staff, promote its laboratories and office equipment facilities, and change its work ways.

Improving manpower knowledge and capability is carried out using Government funds as well as foreign aid. Because of the limitation on funds provided for this purpose, the type of the training mostly supported by the government is non-degree

programs, often organized in cooperation either with another government institution or a university. In this respect, the supporting staff rarely gets an opportunity to increase their knowledge compared to the scientist. Consequently, they often cannot give the quality service needed by the laboratory people. This problem is faced especially at the LIPI Head Office (Bureaus under Deputy for General Affairs).

Recommendation 1:

The Deputy for General Affairs is expected to pay attention to the improvement of knowledge and capabilities of the supporting staff both through government education funds and foreign aid.

Recommendation 2:

Besides being given the opportunity to improve their knowledge and capabilities in order to give better service, the employees should be better managed so as to become more productive and increase their motivation, dedication and creativity in their job. The leaders should encourage them to propose new ideas, and not only follow orders.

Recommendation 3:

Promotion of knowledge and capabilities of its manpower should be supported by modern infrastructure both in laboratories and in Head Offices. Without support from the infrastructure, the improvement of knowledge and capabilities of the manpower could be useless. Especially in the Head Office, the use of computerized administrative services and a suitable database could improve services to the R&D Centres and clients. A technical plan for the provision of infrastructure should be formulated as soon as possible to avoid constraints or problems. Right now, step by step, LIPI is trying to renew its infrastructure with supporting funds from government and foreign aid.

Recommendation 4:

The bureau which actually act as the business office of LIPI is the Bureau of Inter-Institutional Cooperation of Science and Technology (BKI). The tasks of BKI are:

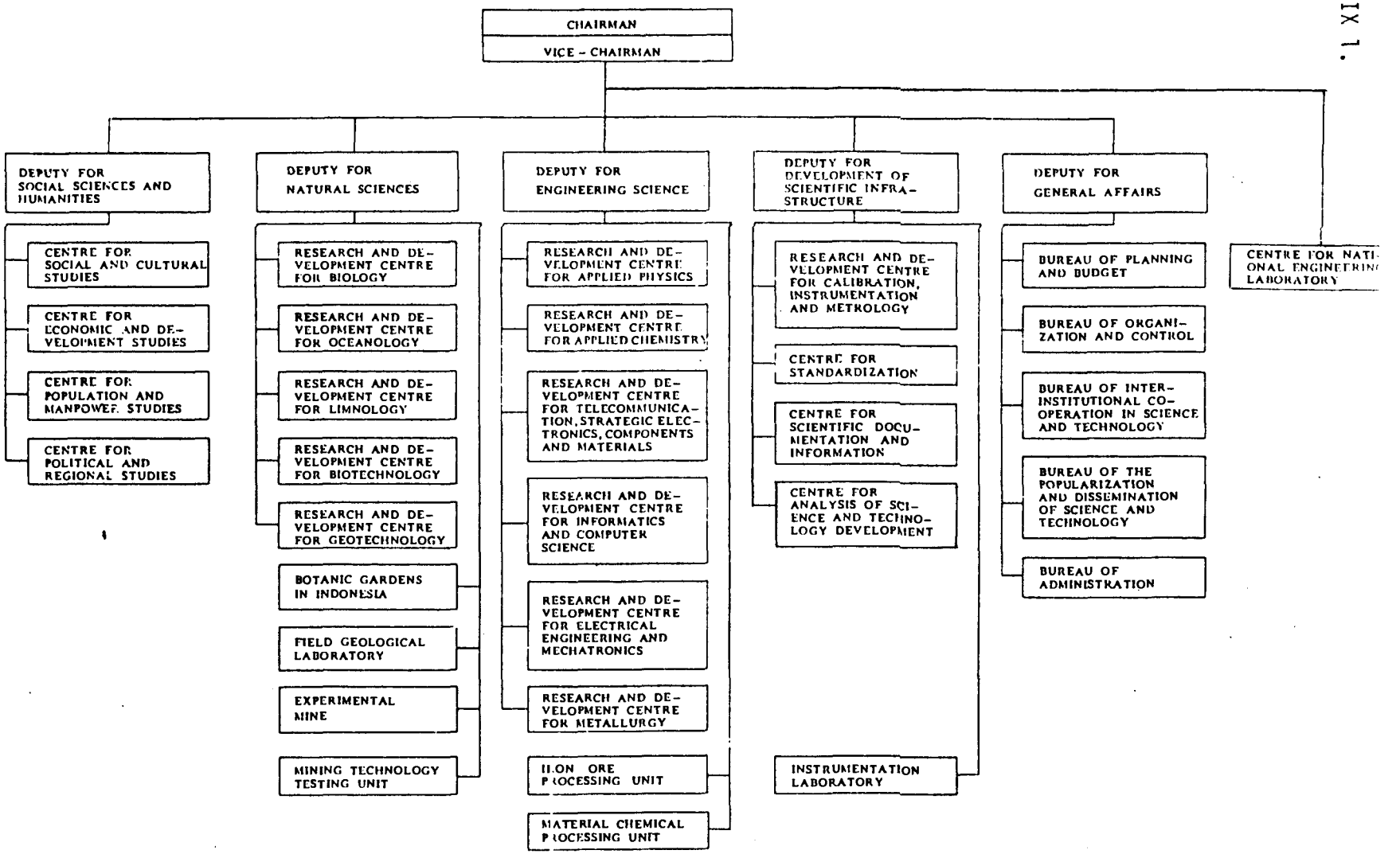
- negotiating and preparing contracts for multinational, bilateral and regional cooperation;
- negotiating and preparing contracts for cooperation between governmental institutions, universities and the private sectors;
- performing the monitoring and evaluation of S&T cooperation projects implemented in each centre within LIPI;
- the legal aspect services;
- scientific authority to issue permits for foreign researchers who intend to carry out research in Indonesia.

As the business office of LIPI, BKI is expected to be pro- active in searching for clients and negotiating increased cooperation. Besides being active as the "gatekeeper" of the Institute, BKI is also expected to develop communication strategies to clients and to ready with all information needed by clients, on LIPI programs, cooperation opportunity programs, brochures, and other materials which related to cooperation activities. These information items should be updated at least annually.

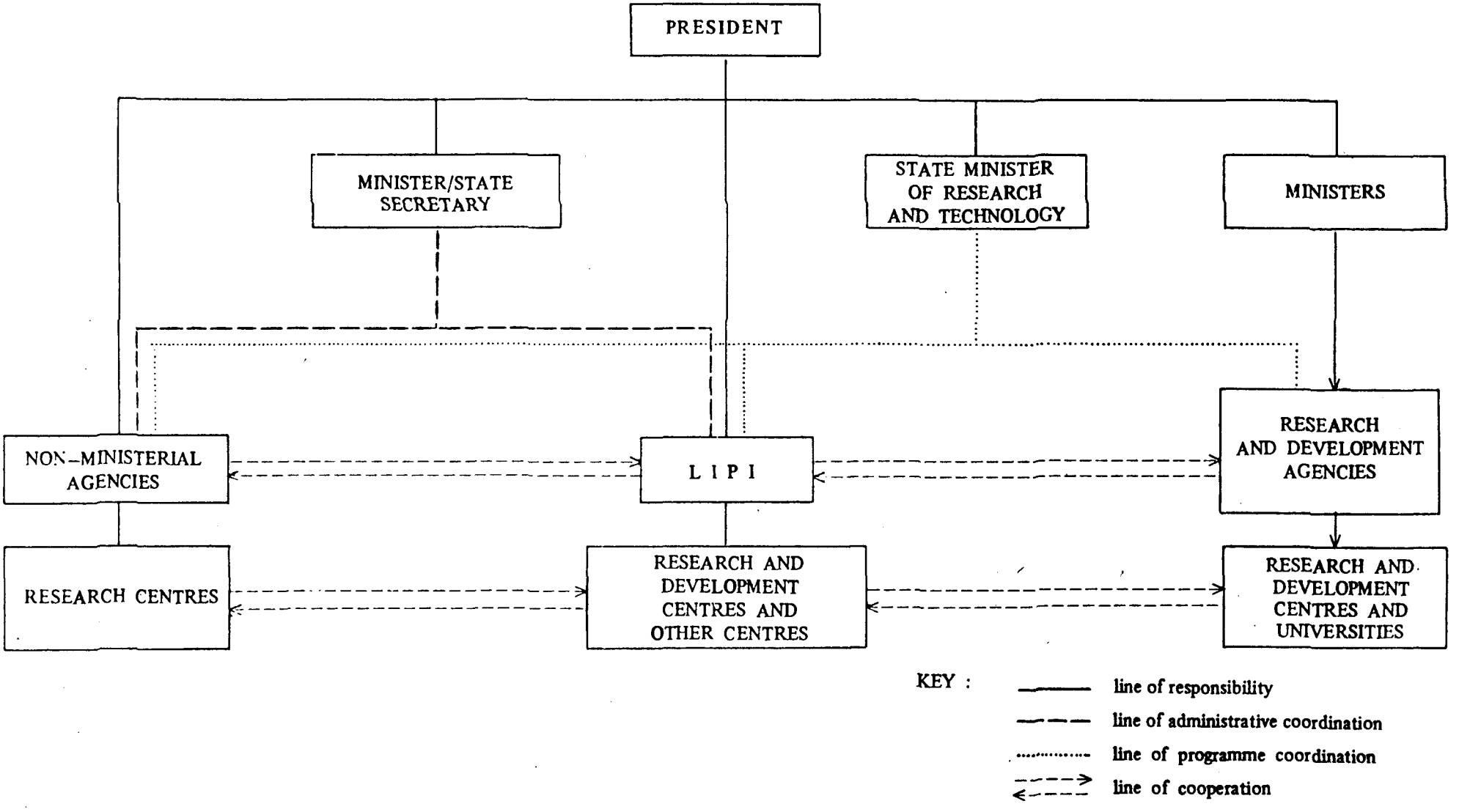
Recommendation 5:

LIPI has to review its programs annually in order to know how far its programs have benefited the Institute itself and clients. In connection with this recommendation, the Advisory Board is expected to be active in the near future. Program review is important for program planning and selection in the future years ahead.

STRUCTURE OF ORGANIZATION OF THE INDONESIAN INSTITUTE OF SCIENCES BASED ON THE PRESIDENTIAL DECREE NO. 1, 1986



THE POSITION OF LIPI IN GOVERNMENT STRUCTURE



APPENDIX 1a.

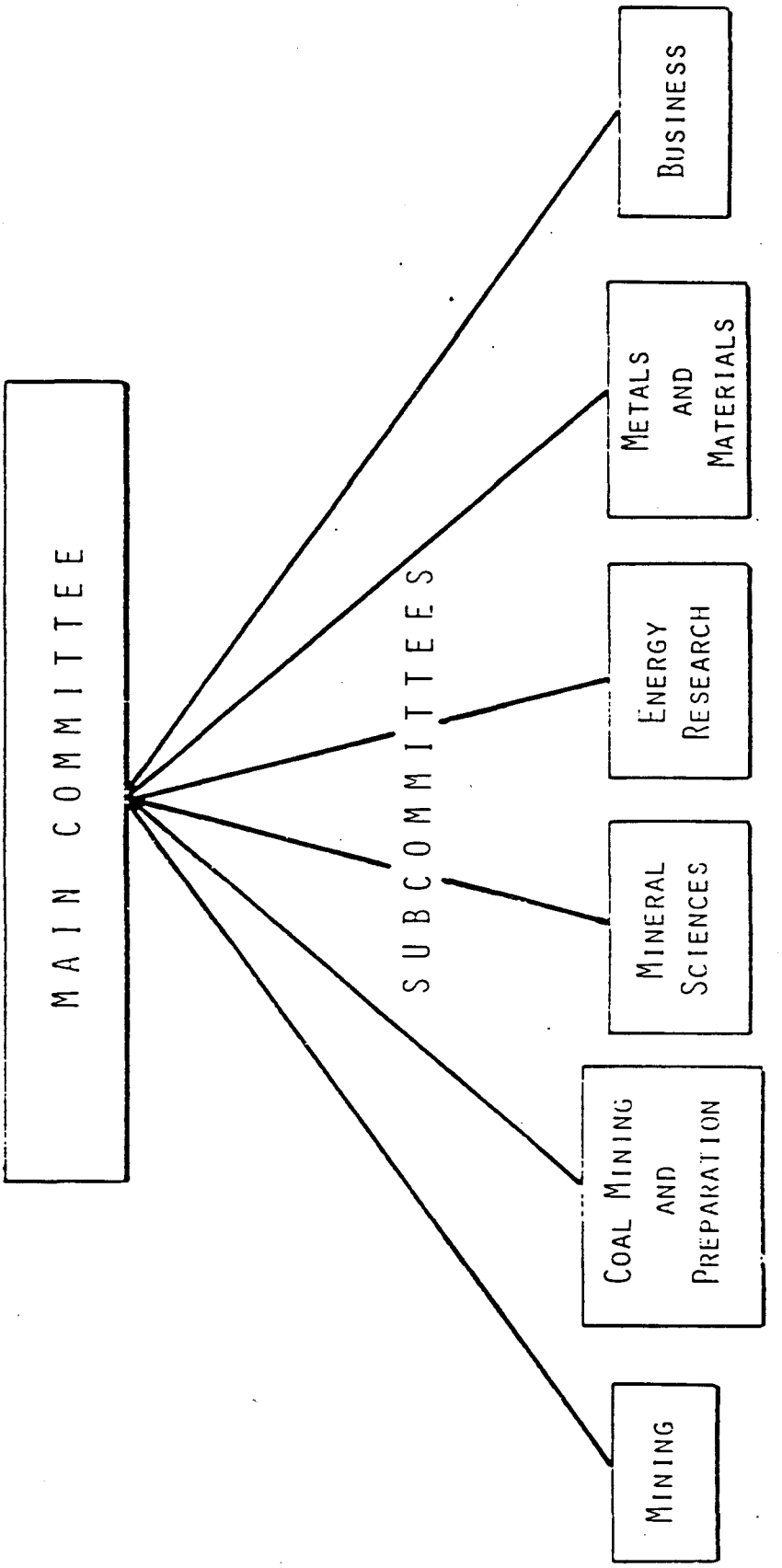
C.2

APPENDIX 2.

MINISTER'S NATIONAL ADVISORY COUNCIL

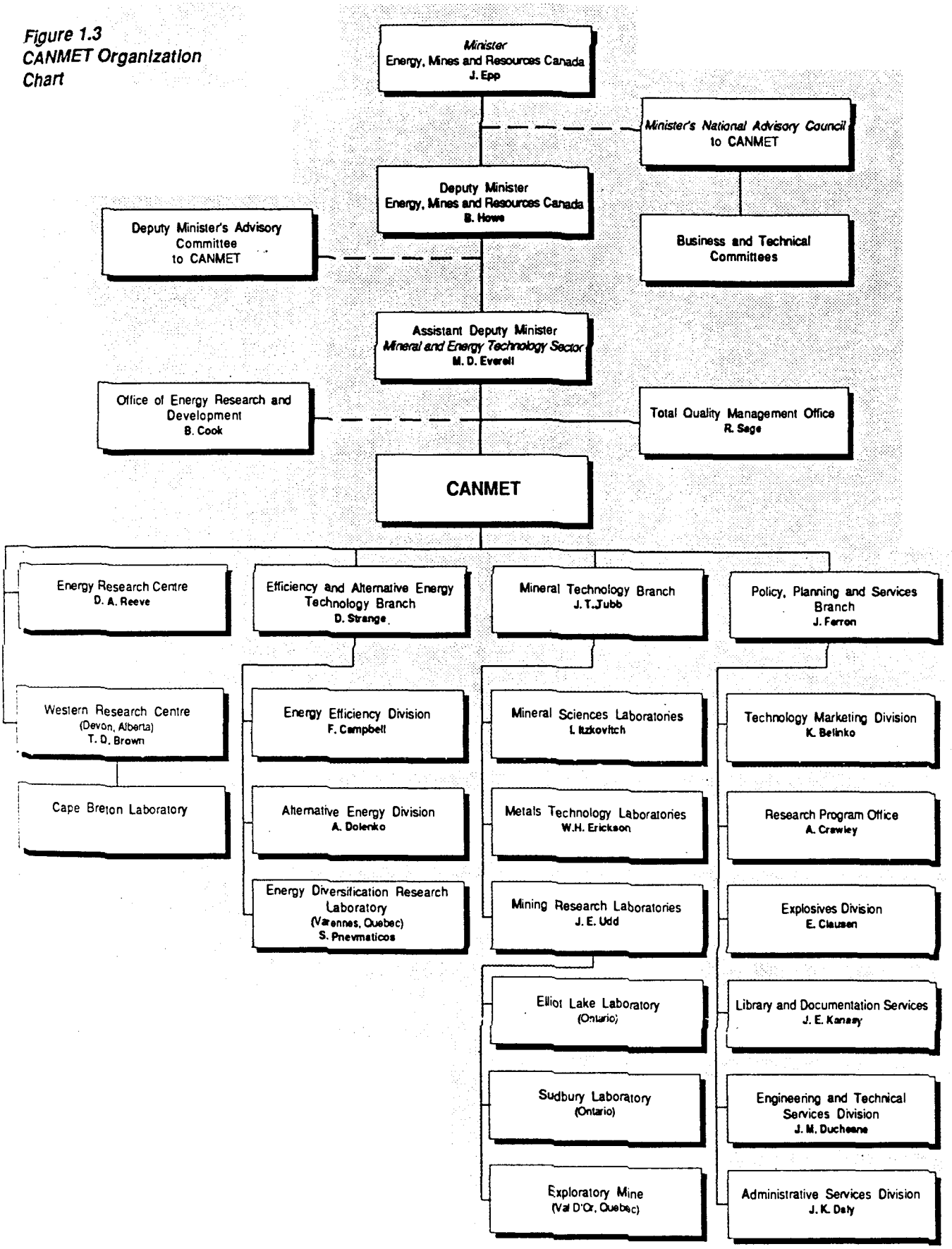
TO

CANMET



APPENDIX 2a.

Figure 1.3
CANMET Organization Chart



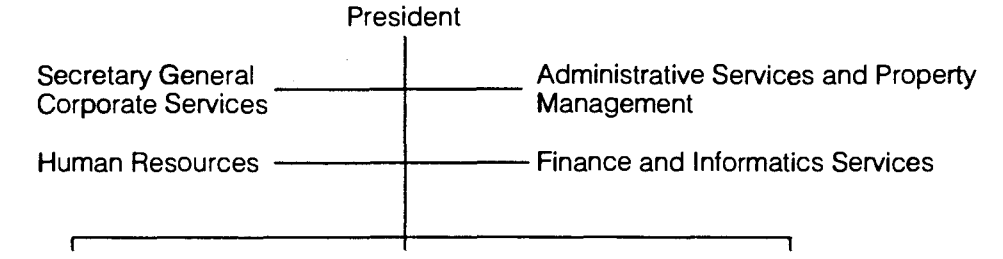
APPENDIX 3.

ADVISORY BOARDS

Institute/Program	Chairman
Aerospace Research	Bill Boggs, Chairman, Field Aviation Holdings Ltd.
Astrophysics	Dr. G.L.H. Harris, Dept. of Physics, University of Waterloo
Biological Sciences	Dr. Graham Strachan, President, Allelix Biopharmaceuticals Inc.
Biotechnology (BRI)	Jacques Gauthier, President, Biomega Inc.
Construction Research Program	Dave Farlinger, Chief Executive Officer, I.D. Group
Environmental Chemistry	Dr. Clarke Henry, General Manager, Research, ESSO Petroleum Canada
Industrial Materials	Dr. Les McLean, President, Stelco Technical Services Ltd.
Industrial Technology (CIIT)	Murray Auld, Retired Chief Executive Officer, Bristol Aerospace Ltd.
Information Technology	George Smyth, President, Bell-Northern Research
Industrial Research Assistance Program	Richard Bourbeau, President, Venmar Inc.
Marine Biosciences	Dr. Kelvin Ogilvie, Vice President, Academic, Acadia University
Marine Dynamics	Rex Parsons, President, Newfoundland Design Assoc. Ltd.
Mechanical Engineering	Brian Sanders, Vice President Engineering, Pratt & Whitney Canada Inc.
Microstructural Sciences	Dr. John Elliott, President, Solid State Optoelectronics Consortium
National Measurement Standards	Allan Crawford, Chairman, Accurex Inc.
Plant Biotechnology	Dr. Wallace Beversdorf, Plant Science, University of Guelph
S&T Information (CISTI)	Robert Gibson, President, Micromedia Ltd.
Scientific Publications	Dr. Glen Caldwell, Vice President, Research, University of Western Ontario
Steacie Institute for Molecular Sciences	Prof. Ronald Steer, Dept. of Chemistry, University of Saskatchewan

APPENDIX 3a.

NATIONAL RESEARCH COUNCIL OF CANADA



Vice-President Engineering and Technology

- Canadian Institute of Industrial Technology
- Institute for Aerospace Research
- Institute for Information Technology
- Institute for Marine Dynamics
- Institute for Mechanical Engineering
- Institute for Research in Construction

- Industrial Research Assistance Program

Vice-President Science

- Herzberg Institute of Astrophysics
- Industrial Materials Institute
- Institute for Environmental Chemistry
- Institute for Microstructural Sciences
- Institute for National Measurement Standards
- Steacie Institute for Molecular Sciences

- Canada Institute for Scientific and Technical Information
- Research Journals

Vice-President Biotechnology

- Biotechnology Research Institute
- Institute for Biological Sciences
- Institute for Marine Biosciences
- Plant Biotechnology Institute

APPENDIX 4.

Client Characteristics

Characteristics	Large Company	Mid Size Company	Small Company
Money	Lots	Little	None
Workforce	Large	Mid-Large	Small
Organization	Bureaucratic	Loose Structure	Entrepreneurial
Style	Conservative Not Invented Here	Risk Takers Open Minded Make Decisions	Risk Takers Good Listeners Want Advice
R&D Facilities	Have R&D Labs	Use other Labs	Do little R&D
Source of technology	Develop it	Buy it	Not aware of it
Accessibility to decicion makers	Headquarters are not near plant site Decision by committee.	All decision makers are at one site.	Decision makers are sometimes on site.
Products	Many	Few	Few - none
Risk	Refusal	Willing ... but	Must take risk

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IDRC PEARSON FELLOWSHIPS PROGRAM

PROACTIVE MANAGEMENT FOR ENHANCING R&D COOPERATION BETWEEN GOVERNMENT RESEARCH INSTITUTES AND THE PRIVATE SECTOR

by

SRI DEWI SOENARIJADI
Bureau of Inter-Institutional Cooperation in S&T
Indonesian Institute of Sciences
Gatot Subroto 10, Jakarta, Indonesia

June 1992

INDONESIA NATIONAL DEVELOPMENT PLAN (R E P E L I T A)

OBJECTIVE :

TO LEARN THE MECHANISMS OF CANADIAN R&D INSTITUTES IN ENHANCING COOPERATION WITH THE INDUSTRIES; AND TO DETERMINE THEIR TO THE INDONESIAN SITUATION

THE STRATEGY OF S&T (SHORT & LONG TERM)

1. AVAILABLE TECHNOLOGY FOR VALUE ADDED OF FINISHED GOODS

2. INTEGRATION OF EXISTING TECHNOLOGY OF PRODUCING NEW GOODS

3. PROMOTION OF INFORMATION ON TECHNOLOGICAL CREATION

4. APPLICATION OF BASIC RESEARCH

TRANSFORMATION OF TECHNOLOGY

1. AVIATION INDUSTRIES
2. MARITIME AND SHIPPING INDUSTRIES
3. LAND TRANSPORTATION INDUSTRIES
4. TELECOMMUNICATION AND ELECTRONIC INDUSTRIES
5. ENERGY INDUSTRIES
6. ASSEMBLING INDUSTRIES
7. AGRICULTURAL IMPLEMENTS & MACHINERY INDUSTRIES
8. DEFENCE INDUSTRIES
9. SOFTWARE INDUSTRIES

RESEARCH DIRECTION

1. RESEARCH AND STUDY ON THE BASIC NEEDS OF MAN

2. RESEARCH AND STUDY ON NATURAL ENERGY RESOURCES AND ENERGY

3. RESEARCH AND STUDY ON INDUSTRY

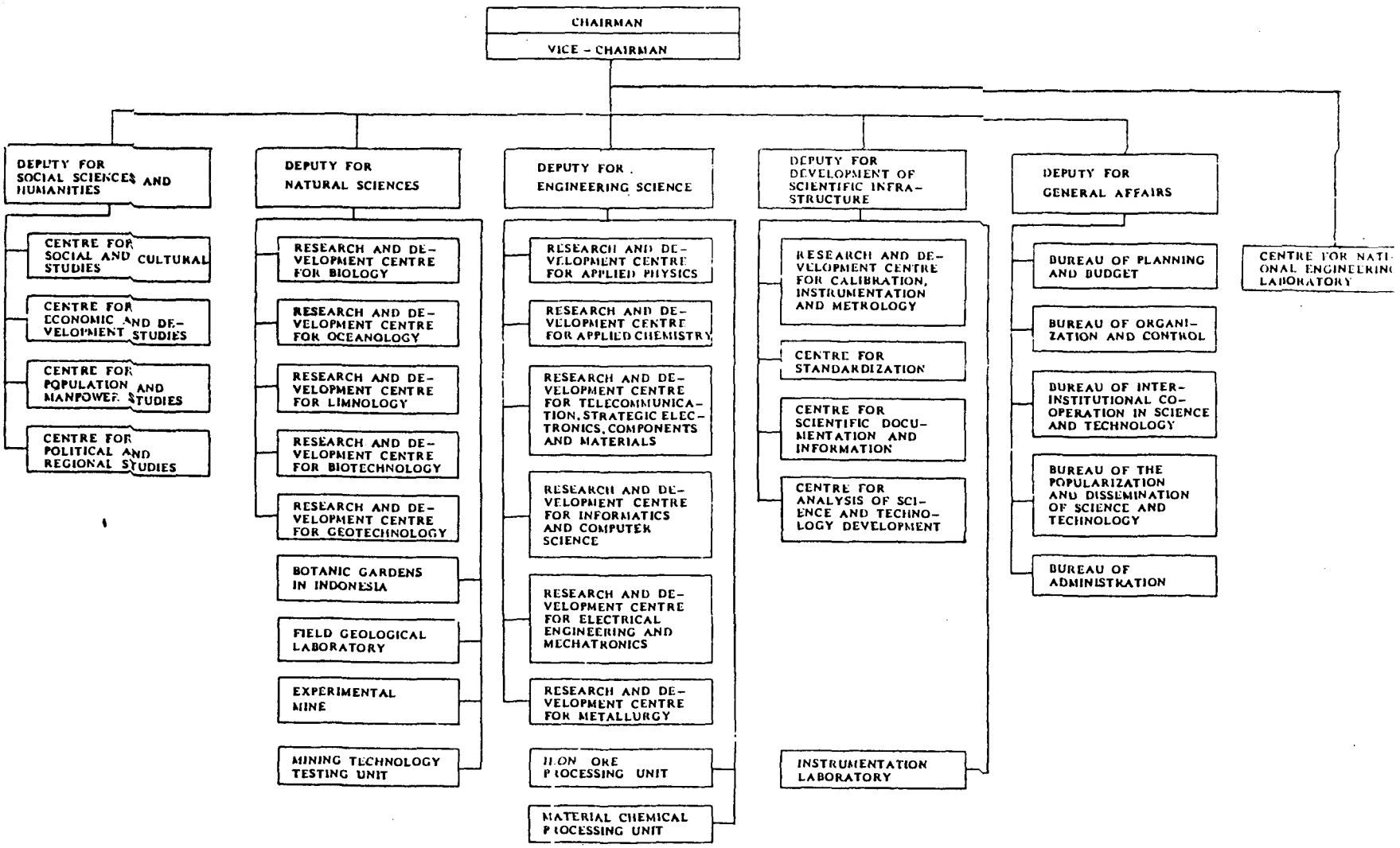
4. RESEARCH AND STUDY ON SOCIO-CULTURE, ECONOMIC, PHILOSOPHY, LAW AND LEGISLATION

BUDGET PERCENTAGE OF S&T IN PROPORTION WITH GNP (1988/89 - 1990/91)

Year	Budget (US$ 000s)		GNP	Budget Percentage	
	R&D	S&T		R&D/GNP	S&T/GNP
1988/89	64,082	235,983	66,357,250	0.096	0.36
1989/90	63,621	286,810	66,700,000	0.095	0.43
1990/91	88,031	389,677	70,026,000	0.126	0.55

Transp. 6

STRUCTURE OF ORGANIZATION OF THE INDONESIAN INSTITUTE OF SCIENCES BASED ON THE PRESIDENTIAL DECREE NO. 1, 1986



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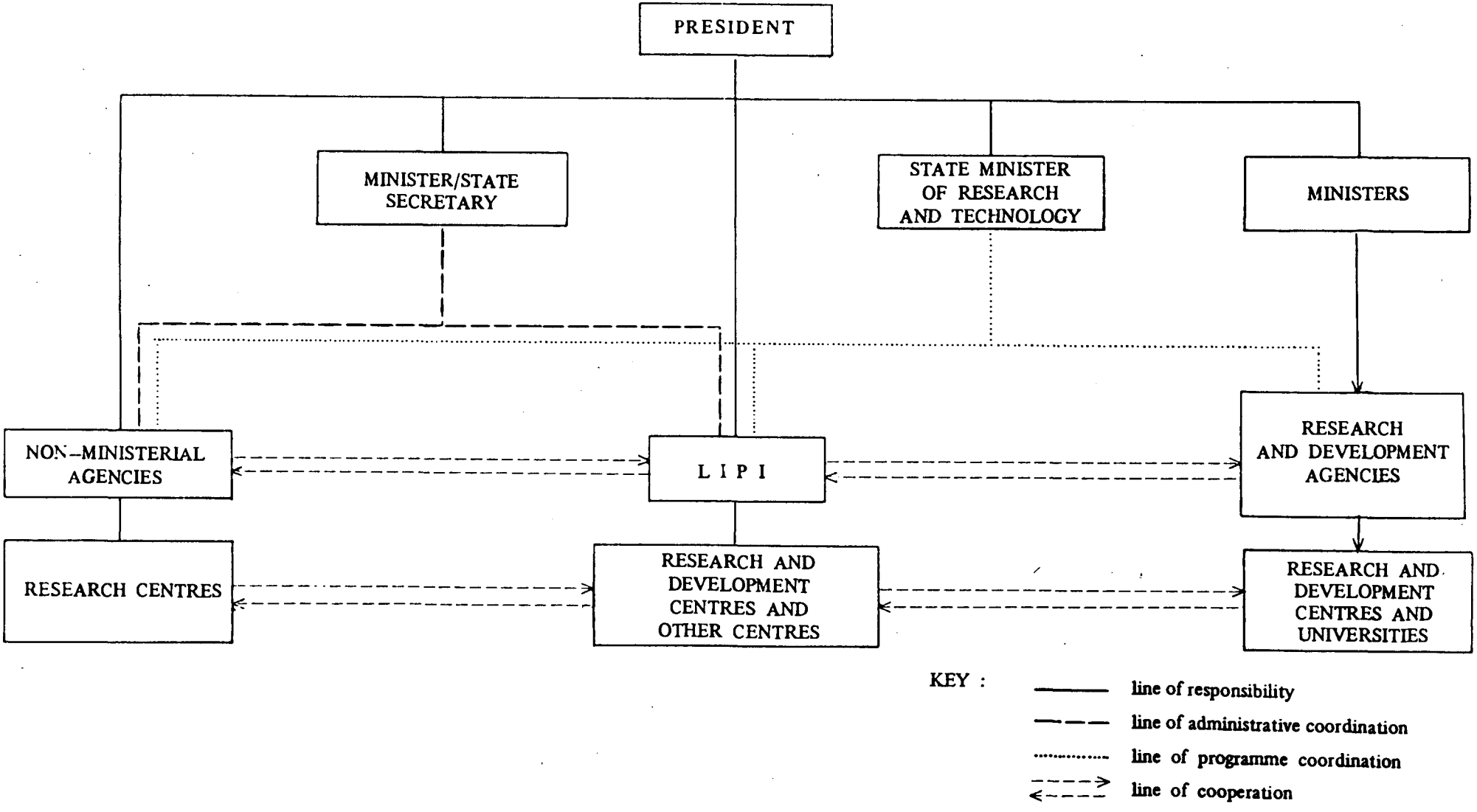
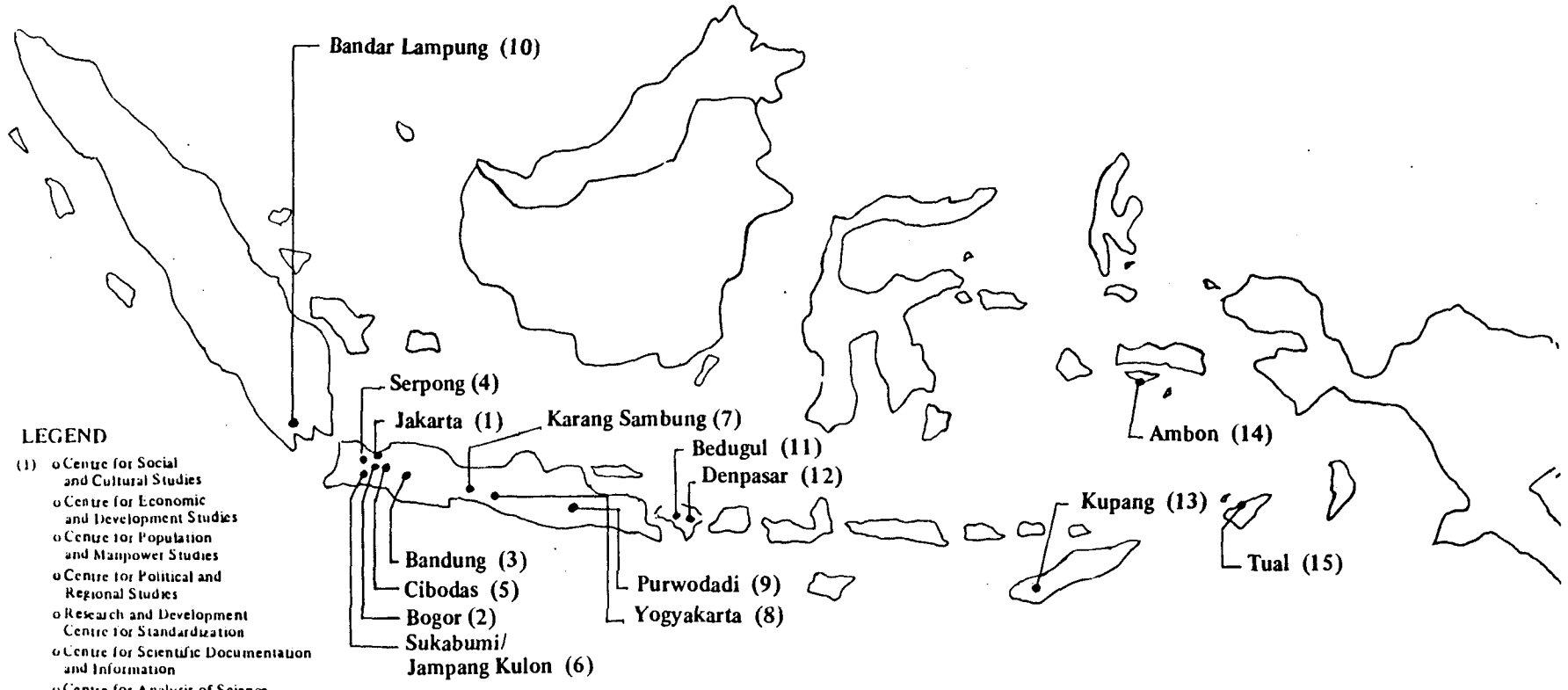


LEMBAGA ILMU[redacted]NGETAHUAN INDONESIA

THE INDONESIAN INSTITUTE OF SCIENCES
LOCATION OF OPERATIONAL UNITS



LEGEND

(1) o Centre for Social and Cultural Studies
o Centre for Economic and Development Studies
o Centre for Population and Manpower Studies
o Centre for Political and Regional Studies
o Research and Development Centre for Standardization
o Centre for Scientific Documentation and Information
o Centre for Analysis of Science and Technology Development
o Bureau of Planning and Budget
o Bureau of Organization and Control
o Bureau of Interinstitutional Cooperation in Science and Technology
o Bureau of the Popularization and Dissemination of Science and Technology
o Bureau of Administration

(2) o Research and Development Centre for Biology
o Research and Development Centre for Limnology
o Research and Development Centre for Biotechnology
o Botanic Gardens in Indonesia

(3) o Research and Development Centre for Geotechnology
o Research and Development Centre for Applied Physics
o Research and Development Centre for Applied Chemistry
o Research and Development C Centre for Telecommunication, Strategic Electronics, Components, and Materials
o Research and Development Centre for Informatics and Computer Science
o Research and Development Centre for Electrical Engineering and Mechatronics
o Research and Development Centre for Metallurgy

o Technical Implementation Unit for Experimental Mine
o Technical Implementation Unit for Material Chemical Processing
– Division for Feed Processing
– Division for Food Processing
– Division for Chemical Processing

(4) o Research and Development Centre for Calibration, Instrumentation and Metrology
o Technical Implementation Unit for Laboratory Instrumentation

(5) o Botanic Gardens in Indonesia, Cibodas Branch, West Java

(6) o Technical Implementation Unit for Experimental Mine

(7) o Technical Implementation Unit for Field Geological Laboratory

(8) o Technical Implementation Unit for Material Chemical Processing, Division for Feed Processing
o Technical Implementation Unit for Materials Chemical Processing
– Division for Food Processing

(9) o Botanic Gardens in Indonesia, Purwodadi Branch, East Java

(10) o Technical Implementation Unit for Ore Processing (Factory)
o Technical Implementation Unit for Mining Technology Testing Unit

(11) o Botanic Gardens in Indonesia, Bedugul Branch, Bali

(12) o Technical Implementation Unit for Materials Processing, Division for Feed Processing

(13) o Technical Implementation Unit for Material Chemical Processing, Division for Feed Processing

(14) o Marine Research Station

(15) o Marine Research Station

LIPI'S MAIN TASKS
(Presidential Decree No.1, 1986)

1. Research and Development in S&T

2. Promotion of the Development of S&T

3. Provision of Scientific and Technological Services

4. Recommendations to the Government on the National Science and Technology Policy

LIPI FUNCTIONS

1. To conduct mission oriented R&D in S&T

2. To provide data and information for national policy on S&T to development

3. To promote development of S&T

4. To promote the public awareness on the role of S&T to development

5. To promote capabilities of Indonesian Scientific Community

6. To promote services in S&T

MANPOWER OF THE INDONESIAN INSTITUTE OF SCIENCES BASED ON EDUCATION IN 1989

EDUCATION	DEP.SSH	DEP.NS	DEP TS	DEP DSI	DEP GA	TOTAL
Doctor (Ph.D)	12	27	20	3	3	65
Master	22	25	35	24	5	111
Univ. Graduate	128	388	266	164	99	1035
Bachelor	15	73	116	88	53	366
SHS Graduate	100	723	660	305	227	2015
JHS Graduate	14	191	99	33	19	356
Primary school	17	524	107	47	47	742
Total	308	1951	1303	664	453	4679

LIPI NATIONAL COOPERATION PROGRAMS

1. Cooperation programs/S&T services (R&D studies, tests of quality, calibration and metrology, installation engineering and training/scientific meeting) within contract are desirable.

2. Direct cooperation/S&T services give directly to the partners/clients, such as material, information, library services etc.

INNOVATION GUIDANCE

1. Industry must play a greater role in supporting science and technology

2. Cooperation among all science and technology players

3. Government pursue certain R&D activities for the public interest, and commercialization of Government Technology

4. Canadian industry strengthen efforts to import of the art foreign technology for Canadian needs

KEY MECHANISMS ENHANCE COOPERATION BETWEEN GOV. R&D INSTITUTES - THE PRIVATE SECTOR

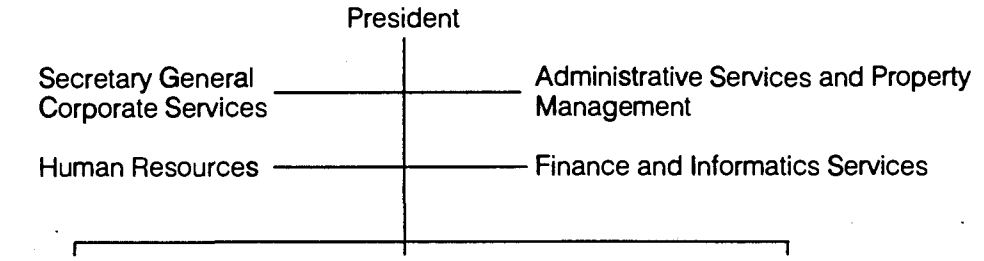
- INDUSTRIAL ADVISORY BOARD
- INDUSTRIAL ASSOCIATION
- SCIENTIFIC AND ENGINEERING SOCIETIES
- BUSINESS OFFICE
- SECONDMENTS
- CONTRACTING-OUT
- PARTNERSHIP AND COLLABORATION
- SERVICE REVENUE
- NATIONAL FACILITIES
- BUILDING CONFIDENCE WITH THE INDUSTRIES
- EXPLORATORY R&D

Client Characteristics

Characteristics	Large Company	Mid Size Company	Small Company
Money	Lots	Little	None
Workforce	Large	Mid-Large	Small
Organization	Bureaucratic	Loose Structure	Entrepreneurial
Style	Conservative Not Invented Here	Risk Takers Open Minded Make Decisions	Risk Takers Good Listeners Want Advice
R&D Facilities	Have R&D Labs	Use other Labs	Do little R&D
Source of technology	Develop it	Buy it	Not aware of it
Accessibility to decicion makers	Headquarters are not near plant site Decision by committee.	All decision makers are at one site.	Decision makers are sometimes on site.
Products	Many	Few	Few - none
Risk	Refusal	Willing ... but	Must take risk

Annex 7

NATIONAL RESEARCH COUNCIL OF CANADA



Vice-President Engineering and Technology

- Canadian Institute of Industrial Technology
- Institute for Aerospace Research
- Institute for Information Technology
- Institute for Marine Dynamics
- Institute for Mechanical Engineering
- Institute for Research in Construction

- Industrial Research Assistance Program

Vice-President Science

- Herzberg Institute of Astrophysics
- Industrial Materials Institute
- Institute for Environmental Chemistry
- Institute for Microstructural Sciences
- Institute for National Measurement Standards
- Steacie Institute for Molecular Sciences

- Canada Institute for Scientific and Technical Information
- Research Journals

Vice-President Biotechnology

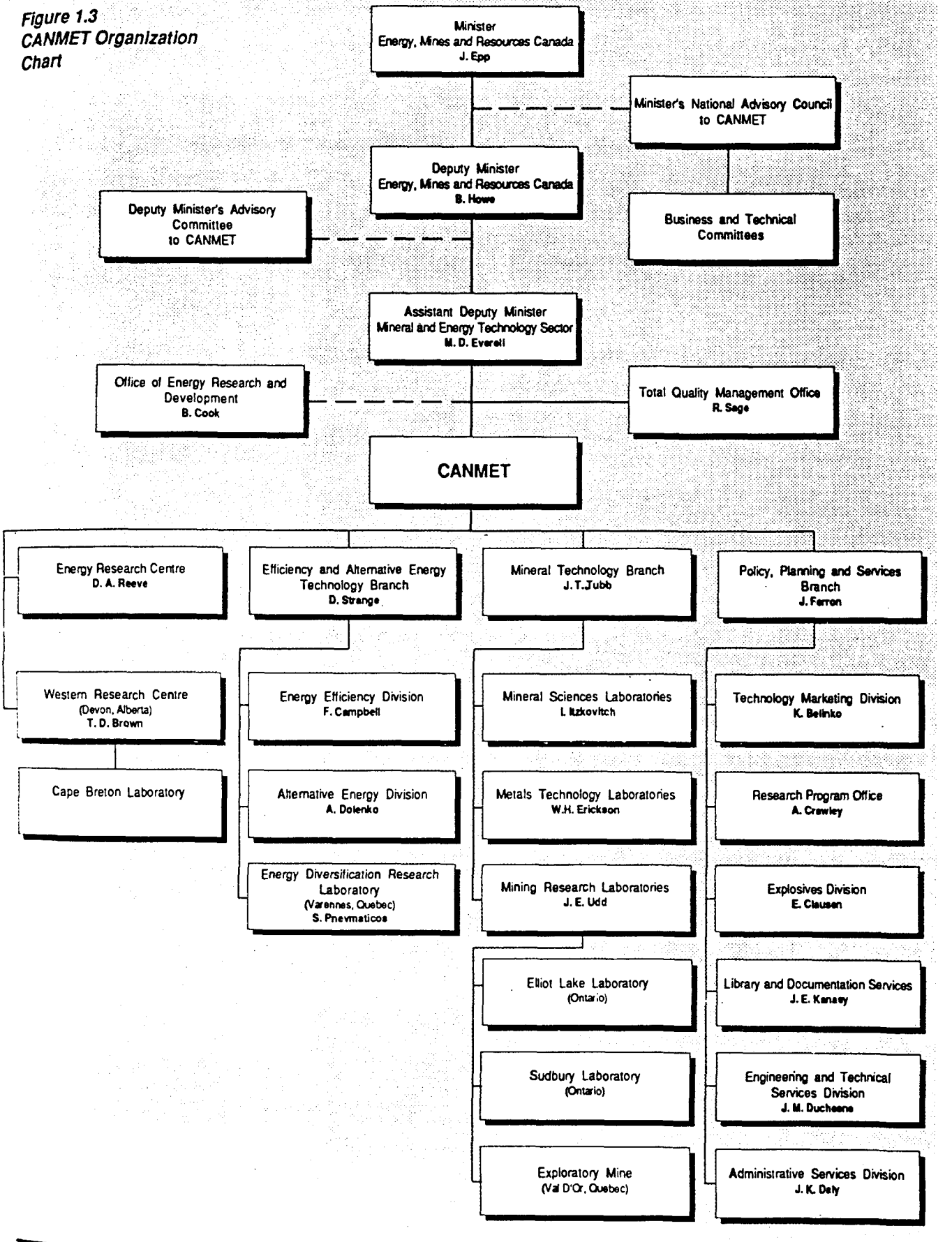
- Biotechnology Research Institute
- Institute for Biological Sciences
- Institute for Marine Biosciences
- Plant Biotechnology Institute

Annex 5

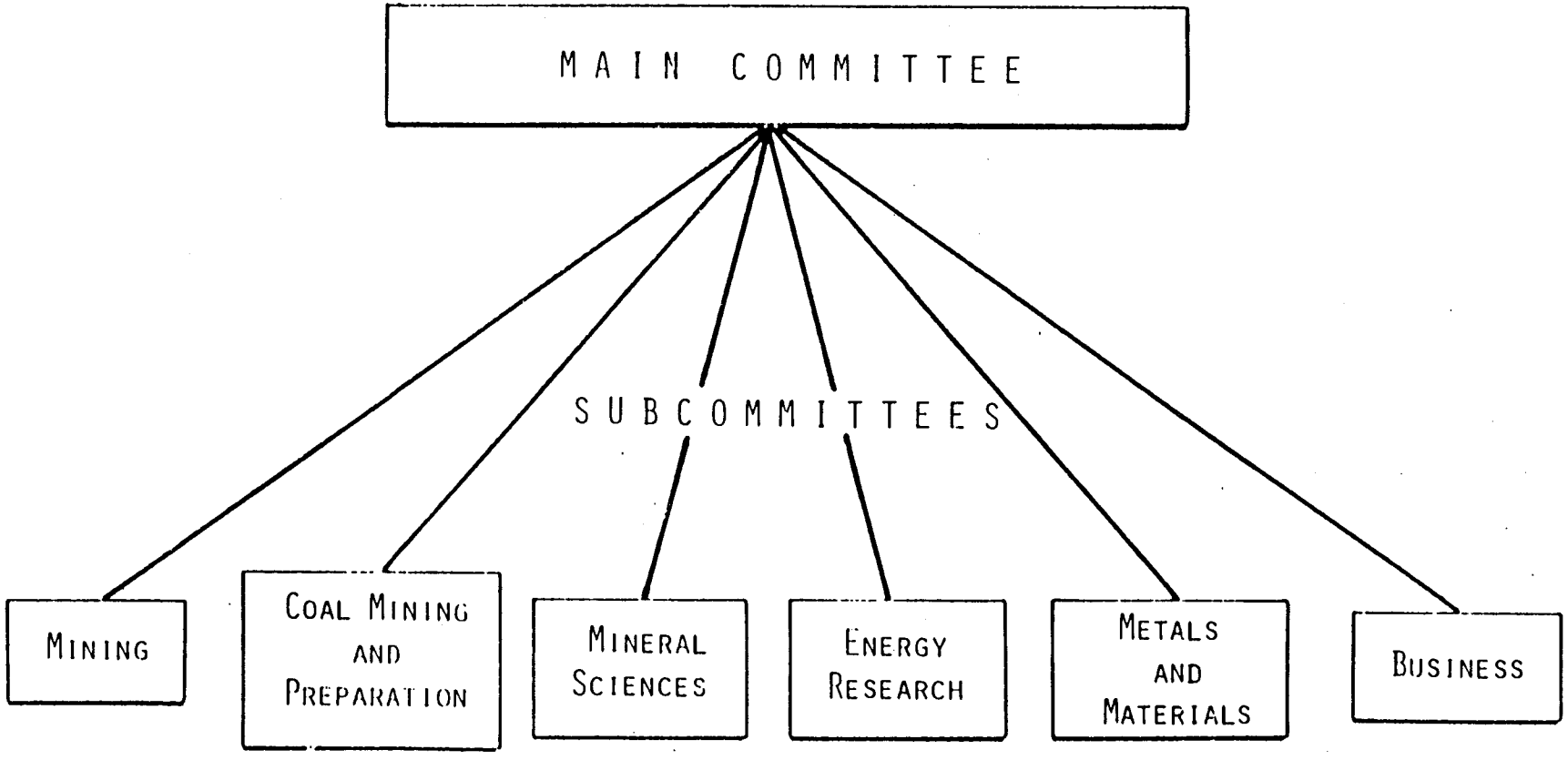
ADVISORY BOARDS

Institute/Program	Chairman
Aerospace Research	Bill Boggs, Chairman, Field Aviation Holdings Ltd.
Astrophysics	Dr. G.L.H. Harris, Dept. of Physics, University of Waterloo
Biological Sciences	Dr. Graham Strachan, President, Allelix Biopharmaceuticals Inc.
Biotechnology (BRI)	Jacques Gauthier, President, Biomega Inc.
Construction Research Program	Dave Farlinger, Chief Executive Officer, I.D. Group
Environmental Chemistry	Dr. Clarke Henry, General Manager, Research, ESSO Petroleum Canada
Industrial Materials	Dr. Les McLean, President, Stelco Technical Services Ltd.
Industrial Technology (CIIT)	Murray Auld, Retired Chief Executive Officer, Bristol Aerospace Ltd.
Information Technology	George Smyth, President, Bell-Northern Research
Industrial Research Assistance Program	Richard Bourbeau, President, Venmar Inc.
Marine Biosciences	Dr. Kelvin Ogilvie, Vice President, Academic, Acadia University
Marine Dynamics	Rex Parsons, President, Newfoundland Design Assoc. Ltd.
Mechanical Engineering	Brian Sanders, Vice President Engineering, Pratt & Whitney Canada Inc.
Microstructural Sciences	Dr. John Elliott, President, Solid State Optoelectronics Consortium
National Measurement Standards	Allan Crawford, Chairman, Accurex Inc.
Plant Biotechnology	Dr. Wallace Beversdorf, Plant Science, University of Guelph
S&T Information (CISTI)	Robert Gibson, President, Micromedia Ltd.
Scientific Publications	Dr. Glen Caldwell, Vice President, Research, University of Western Ontario
Steacie Institute for Molecular Sciences	Prof. Ronald Steer, Dept. of Chemistry, University of Saskatchewan

Figure 1.3
CANMET Organization Chart



MINISTER'S NATIONAL ADVISORY COUNCIL
TO
CANMET



RELATION OF THE GOVERNMENT - INDUSTRY LINKAGES MECHANISMS TO INDONESIAN SITUATION

- Industrial Advisory Board
- Industrial Association
- Professional Societies
- Business Office
- Secondments
- Contracting out, partnership etc.
- Building Confidence with the industries
- Exploratory R&D

RECOMMENDATIONS

1. IMPROVEMENT OF KNOWLEDGE AND CAPABILITIES OF SUPPORTING STAFF

2. MODERN INFRASTRUCTURE

3. PROACTIVE BUSINESS OFFICE

4. PROGRAMS REVIEW